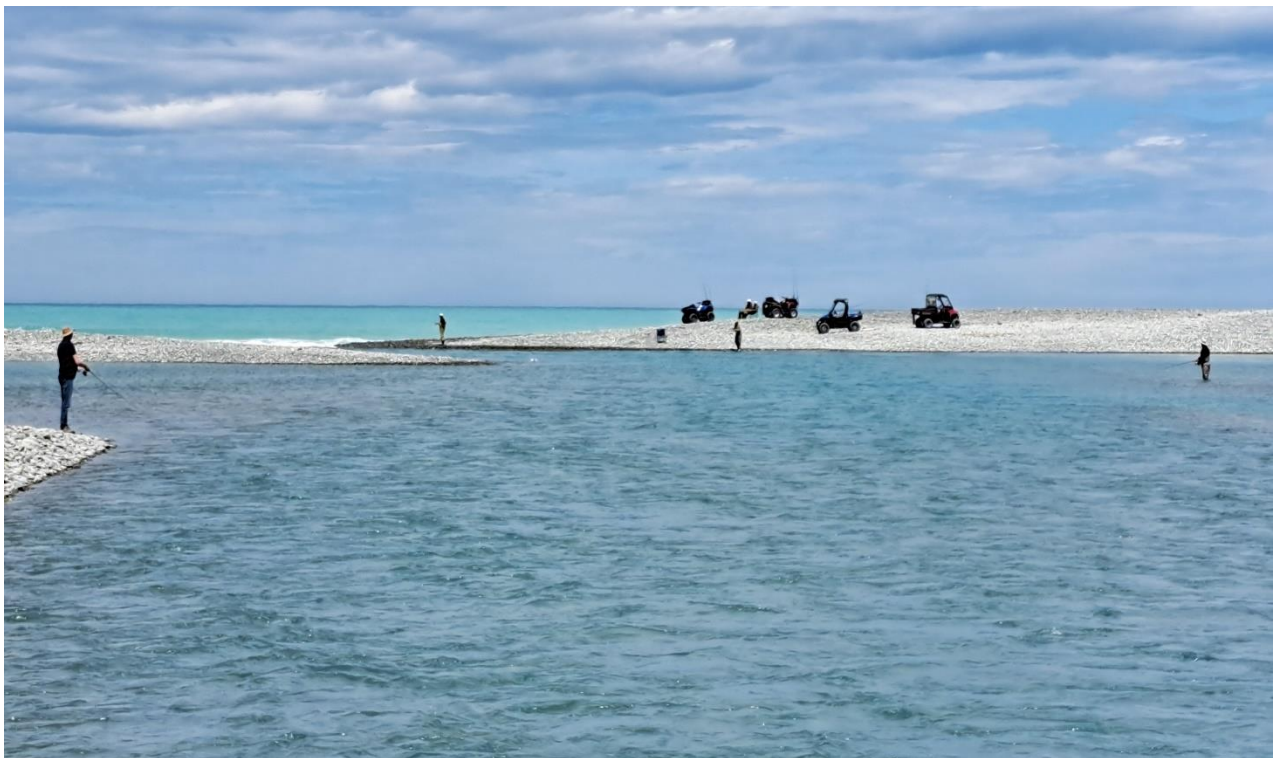




## CENTRAL SOUTH ISLAND REGION

# 2023/24 Central South Island Sea-Run Salmon Returns

Nicola Dellaway  
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*For any information regarding this report please contact Central South Island Fish and Game Council:  
phone: (03)615-8400, email: [csi@fishandgame.org.nz](mailto:csi@fishandgame.org.nz)*

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## Executive Summary

Fish & Game Issued 11,622 sea-run salmon licence endorsements in the 2023/24 season. A decrease of 1,237 on last season.

Fish & Game received 2,351 voluntary season bag card returns and anglers reported a total harvest of 322 sea-run salmon (“salmon”) in the 2023/24 season. 996 random telephone surveys were completed from the remaining anglers and a further 195 salmon were estimated to be harvested equating to a total estimated harvest for North Canterbury and Central South Island regions sea-run salmon fisheries of 517 salmon.

The combined live salmon spawning estimate for the Rakaia, Rangitata/Rakitata and Waimakariri (three indicator rivers) was 1,452 salmon and places the status of the fishery in the ‘low health’ management band (1200 – 5100 spawning salmon). As a result, the North Canterbury and CSI Fish and Game councils resolved to retain the season bag limit of two salmon.

The total salmon run for an individual river is calculated by adding the total spawning estimate for that season to the estimated total harvest for that season. The total run for the Rangitata River for the 2023/24 season was estimated to be 341 salmon, and the Waitaki Rivers total run was estimated to be approximately 794 salmon.

The combined total wild run for the three indicator rivers (Waimakariri, Rakaia and Rangitata) in the 2023/24 season is 1875 salmon.

Prior to the introduction of the management strategy, the proportion of the salmon run escaping anglers and reaching the spawning grounds had been low. This season, the three rivers achieved 70% (Waimak), 73% (Rangitata) and 83% (Rakaia) of the run reaching the spawning grounds, which is considered successful.

## 1.0 Introduction

Mature sea-run Chinook salmon (hereafter also referred to as salmon) return from the Pacific Ocean and enter the rivers to spawn. Salmon are either harvested by anglers, caught and released or avoid anglers (escape) and continue upriver to spawn. Salmon that perish by flood or other means are not considered in this report. The sum of angler harvest and salmon escapement (the spawning population) provides an estimate of the total returned population (total run) of salmon returning to fresh water each season and is the preferred methodology for identifying population trends across seasons. Salmon populations can exhibit large and unpredictable fluctuations in population size on an annual basis, so it is trends across multiple seasons that provide greater insight into the long-term status of the population.

The Central South Island Sports Fish and Game Management Plan (SFGMP) identifies declining salmon populations as one of the region's key issues (8.2.7) and describes the species as being in crisis. The SFGMP emphasizes a desire to arrest the decline of the fishery.

Historical bag limits allowed for anglers to harvest salmon each day of the season which meant that at times anglers were harvesting more than 50% of the total returning population. The introduction of a season bag limit in the 2021/22 season across the Central South Island (CSI) and North Canterbury (NC) Fish and Game regions was one of the most significant changes to the way salmon harvest is managed since salmon were first introduced to New Zealand over 100 years ago. A sea-run salmon licence requires details of every salmon caught to be recorded and returned to Fish & Game. This information assists in the assessment of angler harvest and enforcement of the season bag regulations.

The escapement/spawning component of the run is assessed by two methods in the CSI Region. Salmon redd (nest) counts continue in the Ashburton River system, tributaries of the Rangitata, and the Ōrāri, Ōpihi, Opuha, Tengawai, Waihi-Temuka, Waitaki and Hakataramea rivers when possible. Some of these counts are completed by volunteers. These counts provide a valuable and continuing long-term record used as an index of spawning population size.

The second method used to assess salmon spawning involves five aerial counts of live salmon in the spawning tributaries of the Rangitata River, conducted across the spawning season from March to June. An estimate of Waitaki River spawning was able to be made by this method until about 1999 when the Hakataramea River run began to be impacted by low flows. In recent seasons lower Waitaki River spawning has been assessed by aerial redd count as part of a joint project with Meridian Energy Limited.

Annual estimates of the size of the spawning populations in the Rakaia, Rangitata & Waimakariri is the input to a sea-run salmon population management strategy adopted by Central South Island and North Canterbury Fish and Game Councils in 2020. The strategy sets spawning population thresholds for the Waimakariri, Rakaia and Rangitata river fisheries as a priority before setting the level of harvest able to be sustained and then implemented through the season bag limit.

The following report details the application and results from the third season under the sea-run salmon season bag regime. This includes presentation of timing and size characteristics of harvest, application of the threshold management strategy to Waimakariri, Rakaia and Rangitata sea-run salmon population information, and spawning and harvest information for CSIFG Region fisheries.

## 2.0 Salmon Season Bag Card

### 2.1 Sea-run salmon licences

Anglers are required to obtain a sea-run salmon licence (hereafter referred to as a salmon licence) to be able to fish for sea-run salmon in the Central South Island and North Canterbury Fish & Game regions. This licence takes the form of a season bag limit card and permits anglers to harvest a prescribed season bag limit of two salmon. Anglers are required to record the details of harvested salmon on their season bag limit card and return it to Fish & Game at the end of the season. In the 2023/24 season, a total of 11,622 salmon licences were issued.

Salmon licences issued to CSI and NC Regions comprised 90% of the total licences issued (39% & 51% respectively). The rest of the South Island made up most of the remainder with the North Island holding 1.1%.

**Table 1.** Number of sea-run salmon licences issued in the history of salmon season bag cards across regions.

| <b>Licence Region</b>    | <b>2021/22</b> | <b>2022/23</b> | <b>2023/24</b> |
|--------------------------|----------------|----------------|----------------|
| Nelson/Marlborough       | 567            | 437            | 280            |
| West Coast               | 120            | 93             | 64             |
| North Canterbury         | 5081           | 6385           | 5899           |
| Central South Island     | 2603           | 4882           | 4542           |
| Otago                    | 655            | 625            | 512            |
| Southland                | 216            | 257            | 193            |
| All North Island regions | 196            | 180            | 132            |
| Total                    | 9438           | 12859          | 11622          |

### 2.2 Salmon season bag limit card returns

Season bag card information was voluntarily returned from 2,351 salmon licence holders by online form, post, email or drop-in. Of these voluntary returned cards, 246 anglers (10.5%) reported that they harvested salmon during the 2023/24 season. 908 (39%) anglers reported that they fished for sea-run salmon but did not harvest any salmon. 50.9% reported that they did not fish for sea-run salmon this season.

A random selection of 996 anglers out of the remaining anglers participated in a telephone survey. This resulted in returned data from 3347 anglers.

## 3.0 Salmon Harvest

### 3.1 Mean Angler Harvest

The salmon harvest data is analysed in multiple strata (subgroups). Firstly, we isolated those who voluntarily returned their season bag cards from those who were randomly phone surveyed. The two groups were statistically distinct; therefore, harvest information from the voluntary salmon bag card returns was not extrapolated to anglers who did not return their salmon bag card information (non-respondents). Instead, data from the random telephone survey is used to estimate the results for the 8,275 remaining non-respondents.

### 3.2 Total Harvest

Voluntary season bag card returns reported a total harvest of 322 salmon in the 2023/24 season. A further 195 salmon were estimated to be harvested from the remainder of the salmon bag card holders equating to a total estimated harvest for North Canterbury and Central South Island Regions of 517 ( $\pm 55.9$ ) salmon (Table 2).

#### 3.1.1 Voluntary Respondents

The mean harvest for those who voluntarily returned their season bag card is 0.27 salmon per angler which is three times the mean harvest of those who did not voluntarily return their bag card and were surveyed by phone

#### 3.1.2 Phone Survey

Using previous harvest survey data, we identified anglers who are known to have harvested at least one salmon between 2018-19 and 2022-23 fishing seasons. These anglers are referred to as the “known success” stratum while all remaining anglers are referred to as the “no known success” stratum.

Amongst anglers with known success, 73.4% actively fished for salmon in the 2023/24 season and had an average harvest of 0.26 salmon per angler.

Amongst anglers with no known success, 26.7% of those surveyed actively fished for salmon in the 2023/24 salmon season, with an average harvest of 0.04 salmon per active angler.

### 3.3 Harvest Per River

The Rakaia, Rangitata, Waitaki and Waimakariri rivers sustained more than 95% of the total reported harvest by salmon licence holders (Table 2). Total estimated harvest was greatest for the Rakaia River (186 salmon), followed by the Waimakariri River (143 salmon), the Rangitata River (94.0 salmon), and the Waitaki River (94 salmon) The estimated total harvest has decreased significantly in 2023/24 relative to the past two seasons as shown in table 2.

**Table 2.** Estimated harvest of sea-run salmon in the four large East Coast salmon rivers derived from information returned by anglers over the history of the season bag card.

| River                  | 2021/22 Salmon Harvest | 2022/23 Salmon Harvest | 2023/24 Salmon Harvest |
|------------------------|------------------------|------------------------|------------------------|
| Waimakariri            | 178                    | 245                    | 143                    |
| Rakaia                 | 407                    | 299                    | 186                    |
| Rangitata              | 274                    | 161                    | 94                     |
| Waitaki                | 234                    | 195                    | 94                     |
| Total Harvest 4 Rivers | 1093                   | 900                    | 517                    |

### 3.4 Monthly Harvest

The season bag card requires anglers to record the date which salmon were harvested.

Results show that more than 95% of harvest occurred after January 1st.

Most of the harvest on the Rakaia (80%) and Rangitata (75%) occurred in February and March. The Waimakariri and Waitaki peak harvest occurred later with 77.8% of Waitaki River harvest and 51% of the Waimakariri harvest being in April alone.

The date of peak harvest was later this season than during the previous season in the Rakaia, Waimakariri and Waitaki Rivers while the Rangitata remained similar. Caution must be taken when drawing conclusions about harvest timing and run timing as seasonal bag limits may cause anglers to delay harvesting their salmon in order to extend their fishing season.

### 3.5 Size of Salmon

Traditionally, anglers talk of salmon size in terms of weight, however, by far the most important measure of size from a fishery management perspective is the length. Length data can provide an indication of the age structure of an adult salmon populations. The returning run each season are comprised of two, three, four and sometimes five-year-old salmon. Each year class will have a size range and while there will be significant overlap in size ranges for the different ages, generally the proportion of each year class in the returning run can be identified if the sample size is large enough and the sample is random. This information can be used for assessing the relative survival of each year class through its lifetime.

Salmon bag card return data cannot be classed as a random sample due to the tendency for anglers to catch and release until an acceptably large salmon is caught. This can lead to the sample of angler-caught salmon lengths being biased towards longer and therefore older salmon and not a true reflection of the age composition of the run.

Length data is also a tool for compliance and in time, the data could provide insight to angler behaviours when restricted (or not) to season bag limits.

The average length of all harvested salmon in 2023/24 season was 61.2cm (Table 3), smaller on average than those reported during the previous two seasons which were 67.1cm in 2022/23 and 74.55cm in 2021/22

**Table 3.** Mean, maximum, and most common length (cm) of sea-run salmon harvested during the 2023/24 fishing season in North Canterbury and Central South Island Regions of Fish & Game, as reported by anglers. (Sanders Garrick 2024)

| Length (cm)        | All Rivers | Rakaia  | Rangitata | Waimakariri | Waitaki |
|--------------------|------------|---------|-----------|-------------|---------|
| <i>N</i>           | 309        | 106     | 50        | 78          | 59      |
| <i>Mean</i>        | 61.2       | 60.9    | 64.0      | 61.0        | 59.1    |
| <i>Maximum</i>     | 84.0       | 78.0    | 84.0      | 84.0        | 78.0    |
| <i>Most Common</i> | 60 - 66    | 60 - 65 | 61 - 68   | 59 - 67     | 58 - 65 |

#### 4.0 Salmon Spawning and Run Size

The Waimakariri, Rakaia & Rangitata have annual monitoring programs for spawning and angler harvest that have been undertaken for 31 seasons and have generally been consistent in methodology.

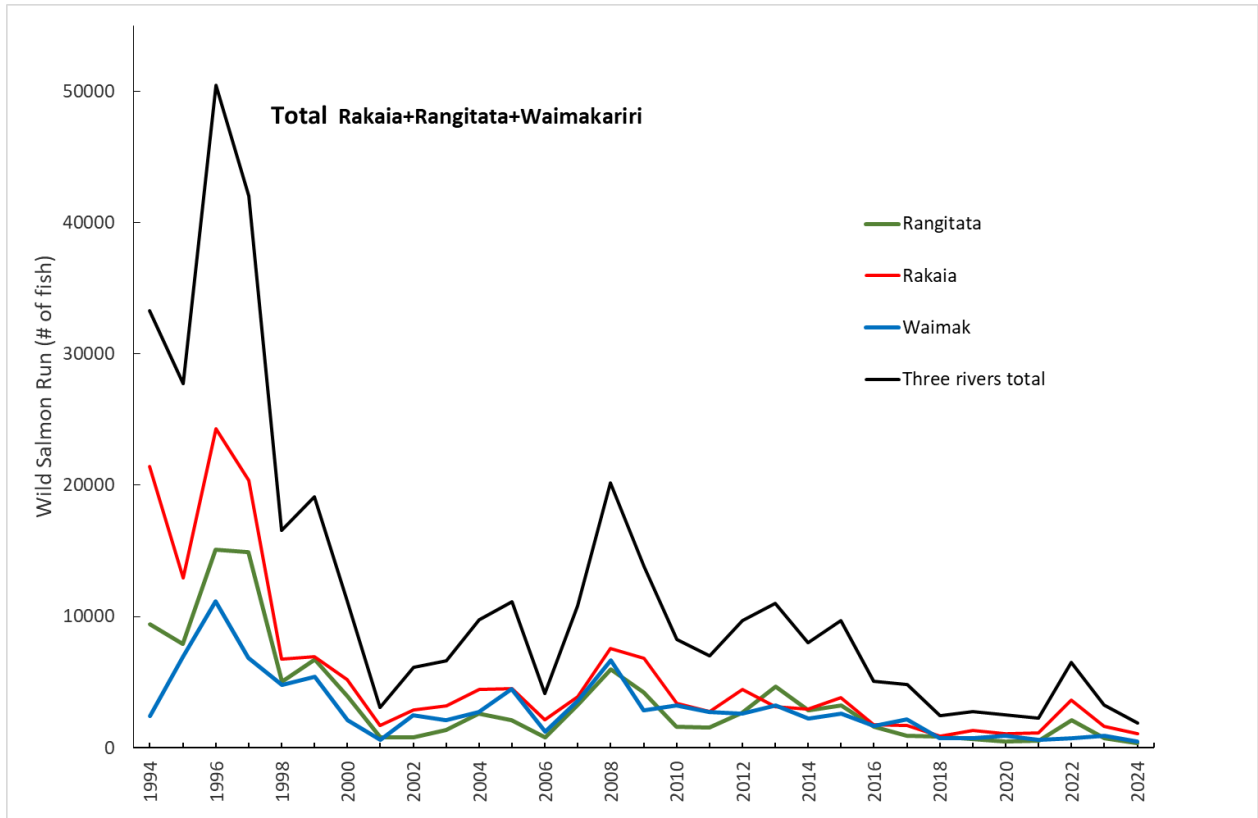
Spawning in the Waimakariri, Rakaia and Rangitata rivers predominantly occurs in a small number of spring-fed tributary streams in their upper reaches.

Estimated salmon harvest plus the spawning population estimates for the three large East Coast salmon rivers indicate “total runs” for these rivers ranging from 341 to 1,064 salmon (Table 4).

**Table 4.** Harvest, Spawning, Total run and Estimated proportion (%) of the returning runs harvested and spawned in the three large East Coast Rivers in the 2023/24 season.

|   | Waimakariri | Rakaia      | Rangitata  |
|---|-------------|-------------|------------|
| Harvest                                   | 143         | 186         | 94         |
| Spawners                                  | 327         | 878         | 247        |
| <b>Total salmon run</b> (harvest + spawn) | <b>470</b>  | <b>1064</b> | <b>341</b> |
| Proportion of run harvested               | 30%         | 17%         | 27%        |
| Proportion of run spawned                 | 70%         | 83%         | 73%        |

The combined wild spawning population for the Waimakariri, Rakaia and Rangitata in the 2023/24 season is 1452 salmon. With the addition of the harvest, the combined wild run for the Waimakariri, Rakaia and Rangitata in the 2023/24 season is 1875 salmon. This is the lowest total run in the 30-season history of the monitoring program (Figure 1). This is 330 less salmon than the previous 30-season low of 2,208 salmon which occurred in the 2020/21 season, the season before the introduction of the season bag limit.



**Figure 1.** Estimated salmon returning to the Rakaia (red), Rangitata (Green), and Waimakariri (Blue) rivers for 1994-2024 and Rakaia, Rangitata & Waimakariri combined (Black)

#### 4.1 Proportion of run spawned

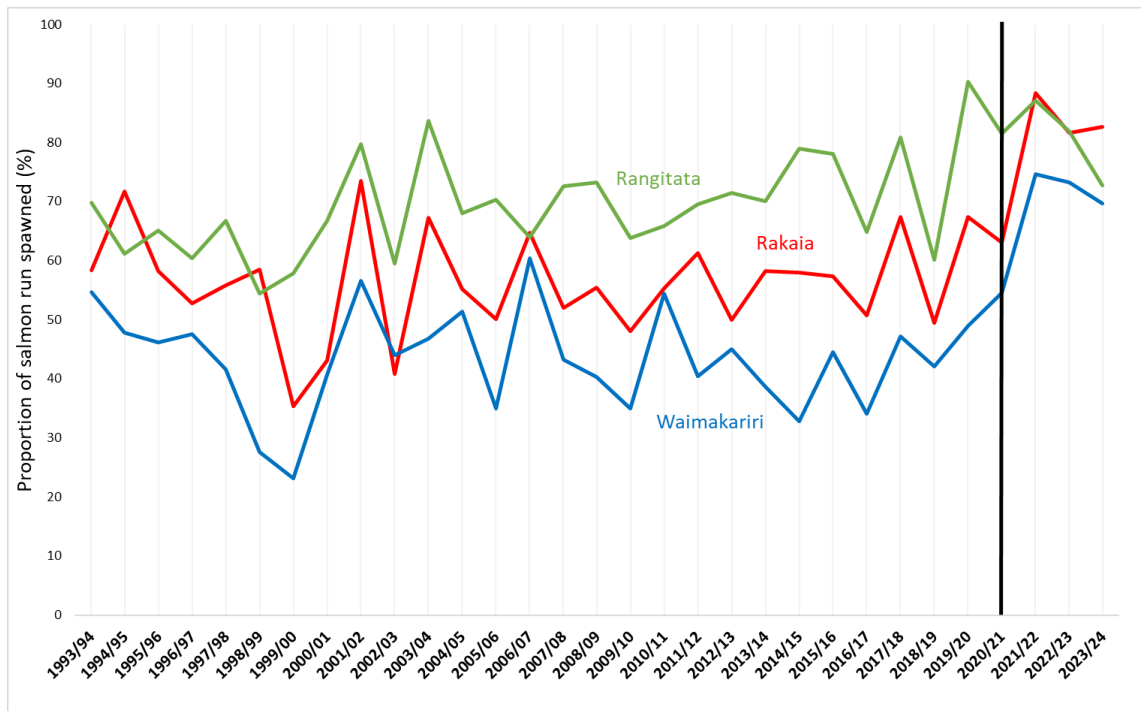
Prior to the introduction of the management strategy, the proportion of the salmon run spawning had been low. For example, over the previous three decades, spawning proportions had often been less than 50% in the Waimakariri River (Figure 4).

In its first season, the introduction of the season bag limit added an estimated 1,500 salmon to the spawning population—salmon that would otherwise have been harvested if harvest rates had remained at 2020/21 levels. The continuation of the season bag limit into the 2023/24 season has once again contributed to a higher-than-average spawning percentage of the total run.

In the 2023/24 season, it was estimated that salmon anglers harvested between 17% and 30% of the returning salmon in the Rangitata, Rakaia, and Waimakariri Rivers, meaning between 70% and 83% of the run successfully escaped anglers and reached the spawning grounds (Table 4).

The Rakaia (80%) and Waimakariri (70%) Rivers achieved some of their highest spawning proportions on record since reliable harvest and spawning surveys began in 1994. The Rangitata River saw 73% of its run reach the spawning grounds, a result considered successful in the context of historical trends (Figure 4).





**Figure 2.** Proportion (%) of the returning runs of wild sea-run salmon that spawned in the Waimakariri (blue), Rakaia (red) and Rangitata (green) rivers for each season since 1993/94. The black vertical line signifies the introduction of the salmon season bag limit before the 2021/22 season.

The implementation of the season bag limit, though still in early stages, appears to have successfully contributed to an increase in the proportion of the salmon run reaching the spawning grounds of the Waimakariri, Rakaia and Rangitata rivers compared to proportions observed prior to the introduction of the strategy. Other factors, such as changes in angler effort, may also have contributed to the observed decrease in harvest and increase in the proportion of the run reaching the spawning grounds.

## 5.0 Management Strategy Implications

Approximately three-quarters of all South Island sea-run salmon caught by anglers are caught in the Waimakariri, Rakaia and Rangitata rivers. Based on these rivers' contributions to the South Island East Coast salmon fishery, their shared population trends, and their on-going population monitoring programmes, in 2020 the CSIFG and NCFG Councils adopted a joint Threshold Management Strategy across the three rivers for setting salmon fishing regulations. The strategy aims to manage angler harvest to ensure adequate numbers of salmon spawn each season, to provide a healthy recreational sports fishery.

The strategy targets the spawning population size of wild salmon since it is from the spawning population in any season that the next generation of adult returns are generated. Annual spawning population monitoring results are also the earliest available measure of the salmon population. Using spawning population size as the guide for harvest management ensures decisions are made on the most up-to-date information.

The strategy identified four spawning population bands that would characterise the health of the spawning populations with the upper band being the level at which the fishery would be considered healthy and where minimum harvest conditions would apply. The second and third

bands would be subject to increasing restrictions on harvest to help prevent the fishery falling below the third band. The fourth band would have maximum harvest restrictions without closing the fishery and this level has been determined to be just below the sum of the lowest recorded spawning population sizes (at the time) in each of the rivers over the long-term monitoring record

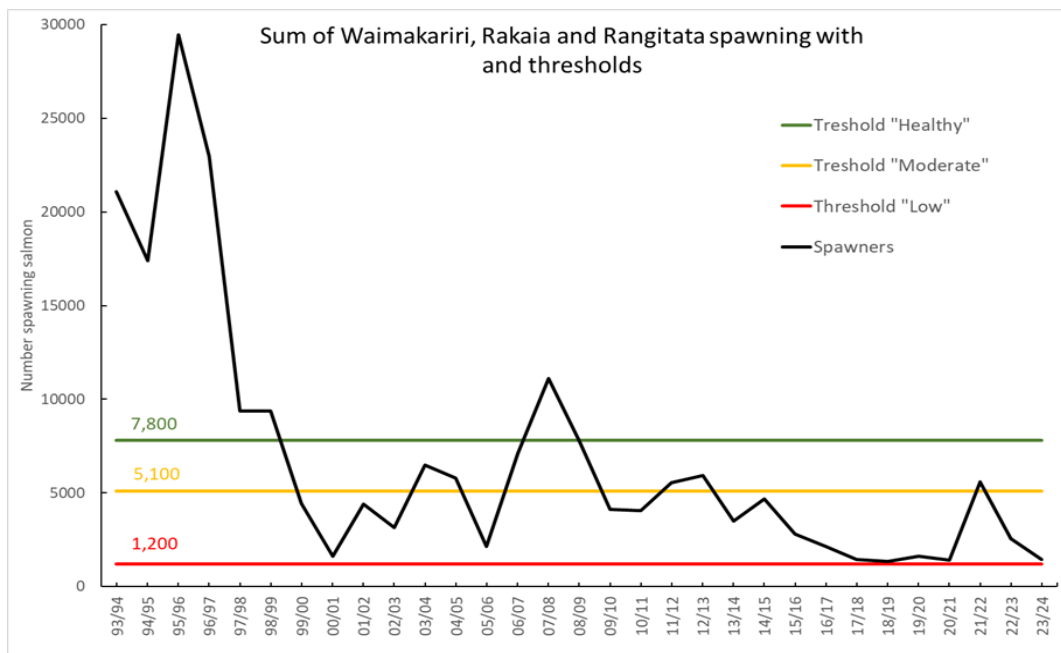
**Table 5.** Threshold Management Strategy combined spawning population bands for the Waimakariri, Rakaia and Rangitata rivers and the season bag conditions triggered from these.

| Management band | Combined number of spawners | Season bag applied |
|-----------------|-----------------------------|--------------------|
| Healthy         | Greater than 7,800          | 10                 |
| Moderate        | 5,101 to 7,800              | 4                  |
| Low             | 1,200 to 5,100              | 2                  |
| Severe          | Less than 1,200             | 1                  |

The 2023/24 combined Waimakariri, Rakaia and Rangitata rivers salmon spawning count was 1452 salmon and places the status of the fishery in the low health band (*table 6*). This season’s live spawning total is just 118 more salmon than the lowest ever combined spawning population that occurred in the 2018/19 season. This season does mark the lowest ever spawning total for the Rangitata River (*figure 3*).

Adhering to the management strategy, the position of the combined spawning population in the ‘low health’ band prescribes that the season bag limit for the 2024/25 season remains at two salmon.

The management strategy requires the estimated spawning population to exceed 5,100 for three consecutive seasons or drop below 1,200 before any change in the bag limit is considered.



**Figure 3.** Combined Waimakariri, Rakaia and Rangitata annual sea-run salmon spawning population (black line) 1993/94 to 2023/24 and Threshold Management Strategy population band thresholds.

## 6.0 Central South Island Fisheries

### 6.1 Ashburton/Hakatere River

The Ashburton River Mouth closed on January 7 and remained closed until April 12, with the exception of March 6 when rough seas carved a temporary opening that quickly closed again the following day.

**Spawning:** No redds were identified in the Māori Lakes outlet during aerial spawning counts and a 35 cumec flood in June prevented the ground spawning survey of Bowyers Stream being undertaken.

**Harvest:** Season bag card returns did not identify any salmon caught in the Ashburton River for the 2023/24 season, nor were any reported by the Ashburton River Mouth diarist.

### 6.2 Ōrāri River

**Spawning:** The Ōhapi South Branch was surveyed in early June and 2 salmon redds were identified. The total wild spawning population in the Ōrāri River is estimated to be to be less than 10 salmon

**Harvest:** Season bag card returns did not identify any salmon caught in the Ōrāri for the 2023/24 season.

**Total Run:** Unlikely to have been more than 10 salmon.

### 6.3 Ōpihi River

**Spawning:** Spawning surveys were undertaken in six identified sections of the Opihi River mainstem, The Opuha/Ōpūaha River and the Waihi-Temuka River. 14 Salmon redds were counted in the Ōpihi River in June and six in the Waihi-Temuka River. 17 salmon redds were identified in the Opuha River in early July though the observer noted that the count may be inflated given the smaller size of some salmon allows for mistaking large trout redds for salmon. Using these counts and previous data, an estimate was made of 41 redds laid and a spawning run of about 100 salmon in the Ōpihi catchment this season.

**Harvest:** A lack of returned data meant that we could not get a total harvest estimate. One salmon was reported to be caught in the sea-run salmon bag card returns.

**Run:** Unlikely to be more than 150 salmon.

### 6.4 Waitaki River

Spawning in the Waitaki River occurs in the 70km of mainstem below the Waitaki Dam. It is almost impossible to undertake repeat live salmon counts to estimate the spawning total for the Waitaki. As a consequence, Waitaki spawning estimates require a further assumption in converting redd counts to live salmon. For this reason, and that consistent annual redd counts for the Waitaki only began in 2013, the Waitaki spawning and run size estimates are not yet extensive or robust enough for contribution to a cross-region sea-run salmon spawning population estimate.

**Spawning:** An estimated 218 redds were counted in the Waitaki catchment this season. This is based on an aerial survey of 35 side streams, four main stem reaches and the Hakataramea River. The catchment count was about average for the previous nine seasons. The Hakataramea

was dry for a period of time over salmon spawning and subsequently only 7 redds were counted in this river.

One fin clipped salmon was reported as harvested from the returns this season and a second fin clipped salmon was reported to have been released.

**Harvest:** Season bag card results, and other surveys estimated 94 salmon caught by anglers

**Run:** The total run is estimated to be no more than 700 salmon.

## 7.0 Hatchery Supplementation

Since 2007, McKinnons Hatchery which operates on a tributary stream of the lower Rangitata has been annually releasing between 5,000 and 95,000, one-year old fin-clipped juvenile salmon to the Rangitata. The 2023/24 season was the 16<sup>th</sup> season where adult returning hatchery-origin salmon have supplemented angler harvest.

For the last five seasons all hatchery-origin salmon released from McKinnons hatchery have been fin-clipped meaning that the proportion of hatchery-origin salmon in the returning run is the number of fin-clipped salmon.

In the 2023/24 season, no McKinnon's-origin fin-clipped salmon were reported to have been caught by anglers fishing the Rangitata. 14 fin-clipped salmon returned to the hatchery. Surveys on the upper Rangitata River spawning grounds did not find any fin-clipped salmon. Overall, McKinnon's-origin salmon totalled 2.7% of the 516 returning salmon in the Rangitata, Ōpihi and Ōrāri rivers in the 2023/24 season (Table 6).

**Table 6.** Estimated number of wild and McKinnons hatchery origin salmon returning to the Rangitata, Ōrāri and Ōpihi rivers that were caught by anglers, or spawned in those rivers, or returned to McKinnons Hatchery for the 2008/09 to 2023/24 seasons.

| River            | Season | Hatchery Origin |                 |                      |       | Wild Origin   |                 |                      |       |
|------------------|--------|-----------------|-----------------|----------------------|-------|---------------|-----------------|----------------------|-------|
|                  |        | Angler caught   | Spawned in wild | Returned to hatchery | Total | Angler caught | Spawned in wild | Returned to hatchery | Total |
| <b>Rangitata</b> | 08/09  | 240             | 39              | 650                  | 929   | 994           | 2,714           | 0                    | 3,708 |
|                  | 09/10  | 68              | 2               | 314                  | 384   | 512           | 901             | 0                    | 1,413 |
|                  | 10/11  | 240             | 33              | 774                  | 1,047 | 483           | 905             | 31                   | 1,419 |
|                  | 11/12  | 237             | 42              | 731                  | 1,010 | 740           | 1,610           | 79                   | 2,429 |
|                  | 12/13  | 68              | 61              | 408                  | 537   | 1,215         | 3,042           | 42                   | 4,299 |
|                  | 13/14  | 294             | 18              | 344                  | 656   | 814           | 1,283           | 621                  | 2,718 |
|                  | 14/15  | 161             | 24              | 64                   | 249   | 978           | 1,666           | 346                  | 2,990 |
|                  | 15/16  | 76              | 15              | 37                   | 128   | 337           | 1,055           | 146                  | 1,538 |
|                  | 16/17  | 30              | 7               | 28                   | 65    | 293           | 498             | 42                   | 833   |
|                  | 17/18  | 23              | 0               | 0                    | 23    | 136           | 573             | 0                    | 709   |
|                  | 18/19  | 60              | 0               | 18                   | 78    | 268           | 403             | 0                    | 671   |
|                  | 19/20  | 61              | 0               | 25                   | 86    | 58            | 437             | 105                  | 600   |
|                  | 20/21  | 15              | 0               | 11                   | 26    | 93            | 397             | 11                   | 501   |
|                  | 21/22  | 14              | 0               | 24                   | 38    | 272           | 1,820           | 13                   | 2,105 |
|                  | 22/23  | 31              | 0               | 72                   | 103   | 130           | 552             | 33                   | 715   |
| 23/24            | 0      | 0               | 14              | 14                   | 94    | 247           | 3               | 344                  |       |
| <b>Ōrāri</b>     | 08/09  | 28              | 72              |                      | 100   | 27            | 48              |                      | 75    |
|                  | 09/10  | 28              | 90              |                      | 118   | 32            | 60              |                      | 92    |
|                  | 10/11  | 70              | 62              |                      | 132   | 23            | 41              |                      | 64    |
|                  | 11/12  | 29              | 49              |                      | 78    | 177           | 51              |                      | 228   |
|                  | 12/13  | 13              | 24              |                      | 37    | 94            | 176             |                      | 270   |
|                  | 13/14  | 270             | 350             |                      | 620   | 371           | 150             |                      | 521   |
|                  | 14/15  | 20              | 4               |                      | 24    | 86            | 12              |                      | 98    |
|                  | 15/16  | 0               | 0               |                      | 0     | 15            | 15              |                      | 30    |
|                  | 16/17  | 4               | 7               |                      | 11    | 22            | 40              |                      | 62    |
|                  | 17/18  | 0               | 0               |                      | 0     | 16            | 50              |                      | 66    |
|                  | 18/19  | 0               | 0               |                      | 0     | 5             | 35              |                      | 40    |
|                  | 19/20  | 13              | 35              |                      | 48    | 0             | 0               |                      | 0     |
|                  | 20/21  | 0               | 0               |                      | 0     | 5             | 30              |                      | 35    |
|                  | 21/22  | 1               | 0               |                      | 1     | 0             | 50              |                      | 50    |
|                  | 22/23  | 1               | 0               |                      | 1     | 1             | 25              |                      | 26    |
| 23/24            | 0      | 0               |                 | 0                    | 0     | <10           |                 | <10                  |       |
| <b>Ōpihi</b>     | 08/09  | 221             | 25              |                      | 246   | 277           | 525             |                      | 802   |
|                  | 09/10  | 137             | 30              |                      | 167   | 197           | 670             |                      | 867   |
|                  | 10/11  | 63              | 32              |                      | 95    | 225           | 668             |                      | 893   |
|                  | 11/12  | 104             | 27              |                      | 131   | 252           | 573             |                      | 825   |
|                  | 12/13  | 13              | 9               |                      | 22    | 665           | 591             |                      | 1,256 |
|                  | 13/14  | 142             | 23              |                      | 165   | 408           | 477             |                      | 885   |
|                  | 14/15  | 10              | 30              |                      | 40    | 28            | 70              |                      | 98    |
|                  | 15/16  | 8               | 24              |                      | 32    | 25            | 76              |                      | 101   |
|                  | 16/17  | 12              | 2               |                      | 14    | 15            | 148             |                      | 163   |
|                  | 17/18  | 0               | 0               |                      | 0     | 33            | 100             |                      | 133   |
|                  | 18/19  | 2               | 4               |                      | 6     | 35            | 71              |                      | 106   |
|                  | 19/20  | 8               | 57              |                      | 65    | 20            | 143             |                      | 163   |
|                  | 20/21  | 5               | 28              |                      | 33    | 13            | 72              |                      | 85    |
|                  | 21/22  | 0               | 0               |                      | 0     | 3             | 130             |                      | 133   |
|                  | 22/23  | 10              | 80              |                      | 90    | 28            | 220             |                      | 248   |
| 23/24            | 0      | 0               |                 | 0                    | 1     | <150          |                 | <150                 |       |

The age composition of returning hatchery-origin salmon has been determined from scale growth ring analysis of angler-caught and hatchery-trapped salmon for some season's returns. In addition, the frequency with which certain sized (length) salmon occur in the hatchery returns can be used to identify age classes of salmon. Age class returns are used to estimate the percentage of return of each cohort (survival) for each release of juvenile salmon from McKinnons Hatchery as depicted in table 7.

**Table 7.** Brood year, year of release, age at return and overall return rate as a percentage of the total number of fin-clipped and non-fin-clipped juvenile salmon released from McKinnons Hatchery. For cohorts yet to return the season of expected return is shown.

| Brood year | Number released | Date of release  | % fin-clipped | No. return 1 <sup>+</sup> | No. return 2 <sup>+</sup> | No. return 3 <sup>+</sup> | Total return | Percent return |
|------------|-----------------|------------------|---------------|---------------------------|---------------------------|---------------------------|--------------|----------------|
| 2006       | 55,000          | July 07          | 100           | 0                         | 1,253                     | 183                       | 1456         | 2.64           |
| 2007       | 72,000          | July 08          | 100           | 22                        | 390                       | 89                        | 544          | 0.75           |
| 2008       | 52,000          | July 09          | 100           | 96                        | 836                       | 7                         | 951          | 1.82           |
| 2009       | 65,000          | July 10          | 100           | 349                       | 1,072                     | 8                         | 1,429        | 2.20           |
| 2010       | 70,000          | July 11          | 53.7          | 189                       | 636                       | 21                        | 846          | 1.21           |
| 2011       | 95,000          | July 12          | 47.4          | 36                        | 1,400                     | 5                         | 1,441        | 1.51           |
| 2012       | 63,000          | July 13          | 68.25         | 20                        | 292                       | 5                         | 317          | 0.50           |
| 2013       | 64,000          | June 14          | 50            | 5                         | 140                       | 5                         | 150          | 0.23           |
| 2014       | 35,000          | Jun 15           | 100           | 15                        | 58                        | 2                         | 75           | 0.21           |
| 2015       | 65,000          | June 16          | 60            | 27                        | 21                        | 42                        | 100          | 0.15           |
| 2016       | 68,000          | Jun/Jul 17       | 0             | -                         | -                         | -                         | -            | -              |
| 2017       | 55,000          | July 18          | 37            | 42                        | 200                       | 3                         | 245          | 0.45           |
| 2018       | 0               | -                | -             | -                         | -                         | -                         | -            | -              |
| 2019       | 7,500           | July 20          | 100           | 8                         | 35                        | 5                         | 48           | 0.64           |
| 2020       | 61,100          | Jan/Jul 21       | 100           | 4                         | 169                       | 1                         | 174          | 0.28           |
| 2021       | 5,000           | Apr/Jul 22       | 100           | 20                        | 12                        | 2024/25                   | 32+          |                |
| 2022       | 81,000          | Feb/Jul 23       | 100           | 1                         | 2024/25                   | 2025/26                   |              |                |
| 2023       | 58,350          | Feb/Jul/Aug 2024 | 100           | 2024/25                   | 2025/26                   | 2026/27                   |              |                |

To date there have been 13 hatchery releases that have run their full life cycle. The 2006 to 2020 broods have completed return out to 3<sup>+</sup> (almost four years old) and produced a range of returns from 0.15% (1.5 salmon returning for every 1,000 released) to 2.64% (26.4 salmon returning for every 1,000 released) and averaged 1.0% (10 salmon returning for every 1,000 released).

## 8.0 References

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James Wright - Forest Creek

Malcolm Prouting – Mesopotamia

Leighton Pye - Ōhapi

Michael Tayler - Ōrāri